PTO 08-0357

CC=JA
DATE=19860906
KIND=Kokai
PN=61201972

ELECTROMOTIVE GOVERNOR VALVE
[Dendo Gabana Ben]

Masahide Takanaka

UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. October 2007
TRANSLATED BY Schreiber Translations, Inc.

PUBLICATION COUNTRY	(10):	Japan
DOCUMENT NUMBER	(11):	S61-201972
DOCUMENT KIND	(12):	Kokai
PUBLICATION DATE	(43):	19860906
APPLICATION NUMBER	(21):	S60-40026
APPLICATION DATE	(22):	19850228
INTERNATIONAL CLASSIFICATION	(51):	F 16 K 31/06
PRIORITY COUNTRY	(33):	N/A
PRIORITY NUMBER	(31):	N/A
PRIORITY DATE	(32):	N/A
INVENTOR(S)	(72):	Masahide Takanaka
APPLICANT(S)	(71):	Keihin Seiki Mfg. Co., Ltd.
DESIGNATED CONTRACTING STATES	(81):	N/A
TITLE	(54):	ELECTROMOTIVE GOVERNOR VALVE
FOREIGN TITLE	[54A]:	Dendo Gabana Ben

1. Title of the invention

Electromotive governor valve

2. Patent Claims

1. An electromotive governor valve which is a governor valve in possession of a fixed valve seat configured within a fluid flow path punching through a valve mainframe, a mobile valve body designed to control opening/closing actions of said fixed valve seat in correspondence to said valve seat, and a pressure receiver designed, upon the reception of a fluid pressure, to bias said mobile valve body along the closing direction and which is characterized by the fact that a motor designed to drive said mobile valve body based on an electric input is configured for inducing correlational variations of the magnitude of the electric signal inputted into said motor and the valve seat aperture area variance of said mobile valve body.

2. An electromotive governor valve which is a governor valve in possession of a fixed valve seat configured within a fluid flow path punching through a valve mainframe, a mobile valve body designed to control opening/closing actions of said fixed valve seat in correspondence to said valve seat, and a pressure receiver designed, upon the reception of a fluid pressure, to bias said mobile valve body along the closing direction and which is characterized by the facts that a motor designed to drive said mobile valve body based on an electric input is configured for inducing correlational variations of the magnitude of the electric signal inputted into said motor and the valve seat aperture area variance of said mobile valve body and that a spring designed to bias said valve body along the closing direction is concomitantly configured.

3. An electromotive governor valve which is a governor valve in possession of a fixed valve seat configured within a fluid flow path punching through a valve mainframe, a mobile valve body designed to control opening/closing actions of said fixed valve seat in correspondence to said valve seat, and a pressure receiver designed, upon the reception of a

fluid pressure, to bias said mobile valve body along the closing direction and which is characterized by the facts that a motor designed to drive said mobile valve body based on an electric input is configured for inducing correlational variations of the magnitude of the electric signal inputted into said motor and the valve seat aperture area variance of said mobile valve body and that the rotation axle of said motor is coupled, by means of screwing, to the valve rod axle of said valve body.

3. <u>Detailed explanation of the invention</u>

(Industrial application fields)

The present invention concerns a correlational control valve designed to control, in a correlational fashion depending on a load, the fluid flow rate of the combustor of a water boiler, etc.

(Prior art)

Electromagnetic governor valves have publicly known as this type of device in the prior art, whereas Japanese Patent Application Publication Kokai No. Sho 58[1983]-217877 Gazette discloses, for example, a constitution provided by internalizing a diaphragm within a valve mainframe, by winding an electromagnetic coil around said diaphragm, and by /2 linking, to the obtained assembly, the valve rod of a valve body linked to a coil bobbin, whereas according to this constitution, the valve body becomes pressed along the closing direction by the pressure of a gas exerted onto the diaphragm for determining the displacement magnitude of the valve body in relation to the value of a current permeated through said coil. Since the valve body is driven by an electromagnet, however, the analog control of the input current is necessary, whereas in a case where a digital computer is interfaced, a digital-analog converter becomes necessary, which is flawed in that an expensive microcomputer control system becomes unavoidable. Since the electromagnet

controls the position of a mobile iron core mobilized along an axial direction identical to the valve body mobilizing direction, furthermore, the state of the valve body changes as a result either of a gas pressure variation or of the impression of a fluid pressure, which is inconvenient in that an imperfect combustion results from the gas flow rate variation. Moreover, there is no correlational correspondence between the displacement magnitude along the axial direction of the valve body and the fluid flow path aperture area variance of the valve, whereas due to such a failure to determine the valve body shape, correlationally corresponding variations cannot necessarily be ensured between the mobile iron core displacement magnitude of the electromagnet and the fluid flow rate.

(Problems to be solved by the invention)

The objective of the present invention, which has been conceived in acknowledgment of the foregoing state of affairs, is to provide an electromotive governor valve bearing a fail-safe structure which can be digitally controlled by a microcomputer, which is unaccompanied by the wavering of a valve body in response to a fluid pressure, and which enables a correlational control of the fluid flow rate of the valve in correspondence to the electric input level.

(Mechanism for solving the problems) & (Functions)

The electromotive governor valve provided by the present invention is a governor valve in possession of a fixed valve seat configured within a fluid flow path punching through a valve mainframe, a mobile valve body designed to control opening/closing actions of said fixed valve seat in correspondence to said valve seat, and a pressure receiver designed, upon the reception of a fluid pressure, to bias said mobile valve body along the closing direction and is characterized by the fact that a motor designed to drive said mobile valve body based on an electric input is configured for inducing correlational variations of the magnitude of the electric signal inputted into said motor and the valve seat aperture area

variance of said mobile valve body, whereas it is also possible to provide a fail-safe structure by concomitantly configuring a spring designed to bias said valve body along the closing direction or by coupling, by means of screwing, the rotation axle of said motor to the valve rod axle of said valve body.

The motor therefore drives the valve body based on a rotational torque more powerful than the electromagnet, whereas the valve seat aperture area variance of the valve is correlationally controlled depending on the magnitude of the electric signal inputted into the motor.

(Application examples)

In the following, an application example of the electromotive governor valve of the present invention will be explained with reference to figures. A fixed valve seat (1) is configured within a fluid flow path punching through the interior of a valve mainframe (10) from an inlet (11) to [an outlet?] (12), whereas configured on the lower end of a valve rod (14) attached fixedly to a pressure receiver (3) (e.g., diaphragm, etc.) pinched & retained in-between a valve lid (13) & the valve mainframe (10) is a mobile valve body (2) in correspondence to the fixed valve seat, whereas a spring (5) is configured, in a contracted state, in-between the mobile valve body and the valve mainframe for perpetually biasing the valve body (2) upward. A motor (4) comprising of a rotating rotor (15) & a fixed stator coil (16) is configured above the valve lid (13), whereas the rotation axle (17) of the rotating rotor is coupled, by means of screwing, to the valve rod axle (18) of the valve rod. A fluid flows from the arrow A to the arrow B, whereas the shape of the valve body (2) is determined in such a way that the gap between the valve body (2) & valve seat (1), namely the fluid flow path aperture area, will vary in proportion to the stroke of the valve body along the axial direction thereof (top & bottom direction).

In other words, the shape of the secondary curvy plane (19) of the valve body (2) is determined in such a way that the fluid flow path aperture area (cyclic area bearing the

length l) will correlationally vary in correspondence to the axial direction stroke h of the valve body (2). In other words, l, which is determined D & d, is designated to correspond correlationally to each stroke h.

Put differently, $l^2 = (D - d)^2 + h^2$ can be ascertained, whereas since the fluid flow path aperture area is proportional to $(D - d)^2 + h^2$, a correlation between $(D - d)^2 + h^2$ & h can be established. Since D is a preknown number, the shape of the supporter installation site (18) is determined by calculating the d value in such a way to induce a correlational variation thereof in relation to h. The flow rate Q transmitting through the aperture area A of a cyclic orifice determined by l, furthermore, can be expressed by the following formula:

$Q = CA\sqrt{\Delta P}$

In the above, Q: Flow rate of fluid transmitted through orifice;

C: Flow rate coefficient;

ΔP: Pressure differential between orifice anterior & posterior.

Since the constriction shape remains virtually invariable in the course of opening & closing actions, the flow rate coefficient C may be presumed to be virtually constant, and therefore, in a case where the pressure differential ΔP is constant, the flow rate Q becomes proportional to the aperture area A according to said formula. Moreover, since the valve aperture area is proportional to the stroke h of the valve body and since the displacement /3 magnitude of the valve body is proportional, via a screwing interface, to the rotating angle of the rotor, a correlation between the rotor rotating angle and the aperture area of the valve can be ascertained, as Figure 3 indicates. It therefore becomes possible to correlationally control the flow rate depending on the magnitude of an electric signal inputted into the motor.

Next, concrete functions will be explained. The rotating rotor (15) of the motor becomes rotated upon the reception of an electric input, whereas the secondary curvy plane (19), the rotation of which is regulated in unison with the rotation of said rotation axle (17), becomes driven, via the screwing interface in a controlled fashion, up & down in accordance with the screw pitch. In a case where the electric input has become shut down due to a

power failure, etc., the valve body becomes pressed & biased along the closing direction by the power of the spring (5), based on which a fail-safe fluid control becomes possible. Since the motor & valve body are mutually coupled via the screwing interface, furthermore, up & down wavers of the valve body due to the effect of the fluid force can be prevented. In a case where a pulse motor is provided as said motor, furthermore, digital control becomes possible, and a direct control via a microcomputer becomes possible.

(Effects of the invention)

As has been demonstrated above, it becomes possible, according to the electromotive governor valve of the present invention, to control, in a stable manner, the drive of the governor valve body based on a powerful drive force generated by a motor, based on which it becomes possible to correlationally control the flow rate in proportion to the magnitude of an electric input signal. Since the valve becomes automatically shut down at the time of a power failure, etc., furthermore, a fail-safe fluid control becomes possible, and up & down wavers of the valve body due to the effect of the fluid force can be avoided. Moreover, a direct microcomputer control becomes possible by orchestrating a pulse motor which can be controlled by digital signals.

4. <u>Brief explanation of the figures</u>

Figure 1 is a lengthwise cross-sectional view diagram which shows an application example of the electromotive governor valve of the present invention, whereas Figure 2 is a diagram which shows a partial cross-sectional view of a valve open state in Figure 1, whereas Figure 3 is a line graph which shows the relationship between the aperture area of the valve of Figure 1 and the rotor rotational angle.

(1): Valve seat; (2): Valve body; (3): Pressure receiver; (4): Motor; (5): Spring.

Patent Applicant: Keihin Seiki Mfg. Co., Ltd.

Agent: Hiroshi Ikeda, patent attorney

Figure 1

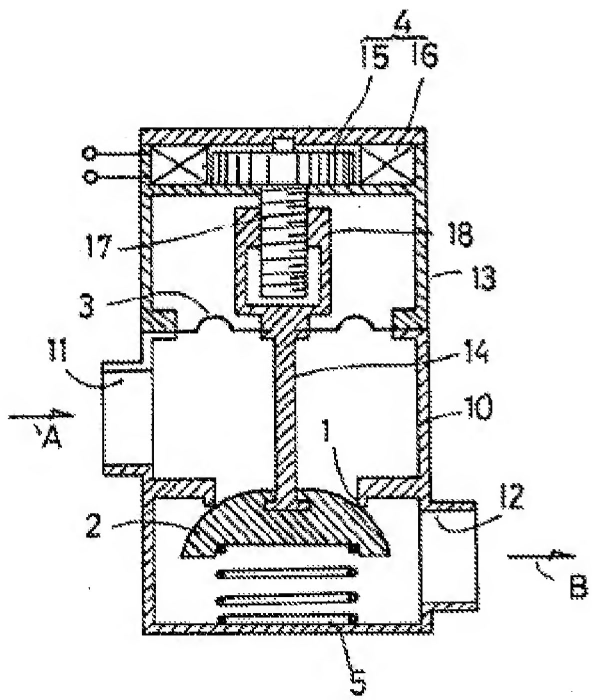


Figure 2

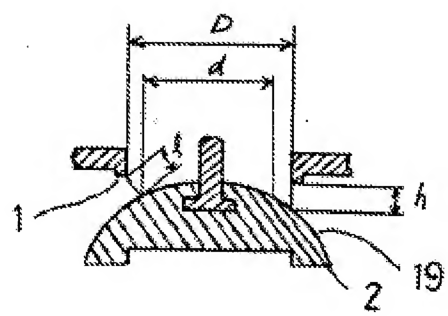
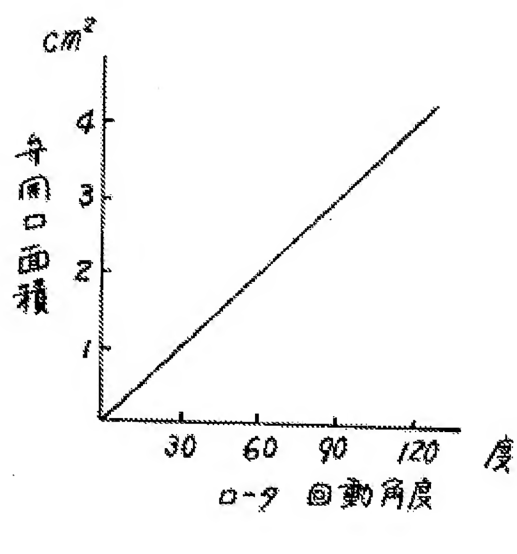


Figure 3



[(1): Valve aperture area; (2): Rotor rotational angle (°)]